

*A Contribution to the Embryogeny of the Chalcididæ.*

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The few observations which have been made upon the development of the entomophagous Hymenoptera have shown that the embryogeny of those species which have been studied hitherto is characterized by the absence of nutritive vitellus in the ovum, by the existence of a single embryonic envelope differing from the amnion of the other Insecta, and by the constitution of the larva. As I have had the opportunity of encountering in some larvæ of *Stratiomys strigosa* several stages in the development of a Chalcid parasite, *Smicra clavipes*, with which Swammerdam was already acquainted, I think it will be useful, in spite of the numerous gaps which my investigation exhibits, to mention the facts which I have observed.

In a *Stratiomys*-larva attacked by *Smicra* we find some fifty ova at different stages of development. The youngest which I have examined measured  $150\ \mu$  in length by  $50\ \mu$  in breadth. These ova have the form of an elongated ovoid, terminated at each extremity by an appendix like the finger of a glove. The chorion of the ovum is very delicate and perfectly homogeneous; its inner surface is clothed by a cellular membrane, formed of a single layer of little flattened cells. Inside this membrane a clear space, filled with fluid, surrounds a solid elongated cellular mass, which results from the total segmentation of the formative vitellus. The cellular membrane probably owes its origin to a very precocious differentiation of the periphery of the segmented vitellus, and constitutes an embryonic membrane which is comparable to that of the Scorpions and of *Polyxenus*.

The ovum, in consequence of progressive development, increases in volume; its chorion becomes distended; the appendices shaped like the finger of a glove disappear almost entirely, and are only represented by two little points which are scarcely visible. At the same time the embryonic membrane increases in area, but without the multiplication of its cells. The latter become enlarged by flattening themselves out more and more; they attain very great dimensions, and each possess a nucleus of considerable bulk.

During the growth of the ovum the central cellular mass becomes hollowed out and differentiates by delamination into two layers, one of which is ectodermic, the other endodermic. The nervous system is formed on the ventral face by two ectodermic thickenings, situated on each side of the median line. At the same time between the two primitive layers of the blastoderm mesodermic elements appear, the origin of which I have not been able to determine. The segments of the body become visible; the cephalic portion is slightly larger than the rest of the body, and exhibits in front a little papilla, on which the mouth-parts will subsequently appear.

At this point the ovum is about  $600\ \mu$  in length by  $420\ \mu$  in breadth; it has become about two hundred times larger than it was at first. The embryonic membrane, which is separated from the

chorion and from the embryo by a thick layer of albuminous fluid, is still intact, when the little vermiform larva, destitute of any kind of appendages except rudimentary mouth-parts, is already well formed and begins to exhibit movements. At this moment the large flattened cells of the embryonic membrane separate from one another, become free, and assume a globular form; they undergo a fatty degeneration and float freely, isolated or in little groups, in the liquid which surrounds the embryo.

When the larva of *Smicra* emerges it presents almost the same constitution as that of *Encyrtus fuscicollis*, recently described by Bugnion\*; it differs from it, however, in its nervous system, which is formed by a double chain in which the ganglia are sharply distinct and which is in connexion with well-developed supra-oesophageal centres. It terminates posteriorly in an acuminate extremity, in front of which opens the anus. The hind-gut, which is very short, does not appear to be in communication with the mid-gut, which is filled with a yellowish liquid without any traces of formed elements.

A large number of embryos of *Smicra* die before arriving at the limit of their development and undergo a fatty degeneration in the interior of the ovum; in addition to this the ova are frequently attacked by the mycelium of a fungus, which perforates the chorion and develops in the albuminous liquid. The presence of this fungus does not appear to injure the larva of the *Stratiomys*, the tissues of which remain perfectly healthy. I have never found more than two or three well-developed larvæ of *Smicra* in the same *Stratiomys*-larva.

The stages which I have so far observed enable me to establish the following facts:—

In *Smicra* the segmentation of the ovum is total; a single embryonic membrane appears at an early period, before the formation of the embryo, by a process very different from that which gives origin to the amnion of other insects. The ovum undergoes a considerable increase in bulk during its development, owing to the remarkable elasticity of its chorion. The embryonic membrane follows the growth of the embryo; the cells attain large dimensions and do not multiply. When the embryo is well formed the cells of the embryonic membrane separate and enter upon fatty degeneration. The ovum borrows from the blood of its host by endosmosis the nutritive materials necessary for its development. Even for a long time after emerging the larva appears to nourish itself only at the expense of the blood of its host.—*Comptes Rendus*, tome cxiv. no. 3 (January 18, 1892), pp. 133–136.

\* 'Recueil zoologique suisse,' t. v. (1890).